Winter Weather Hazards

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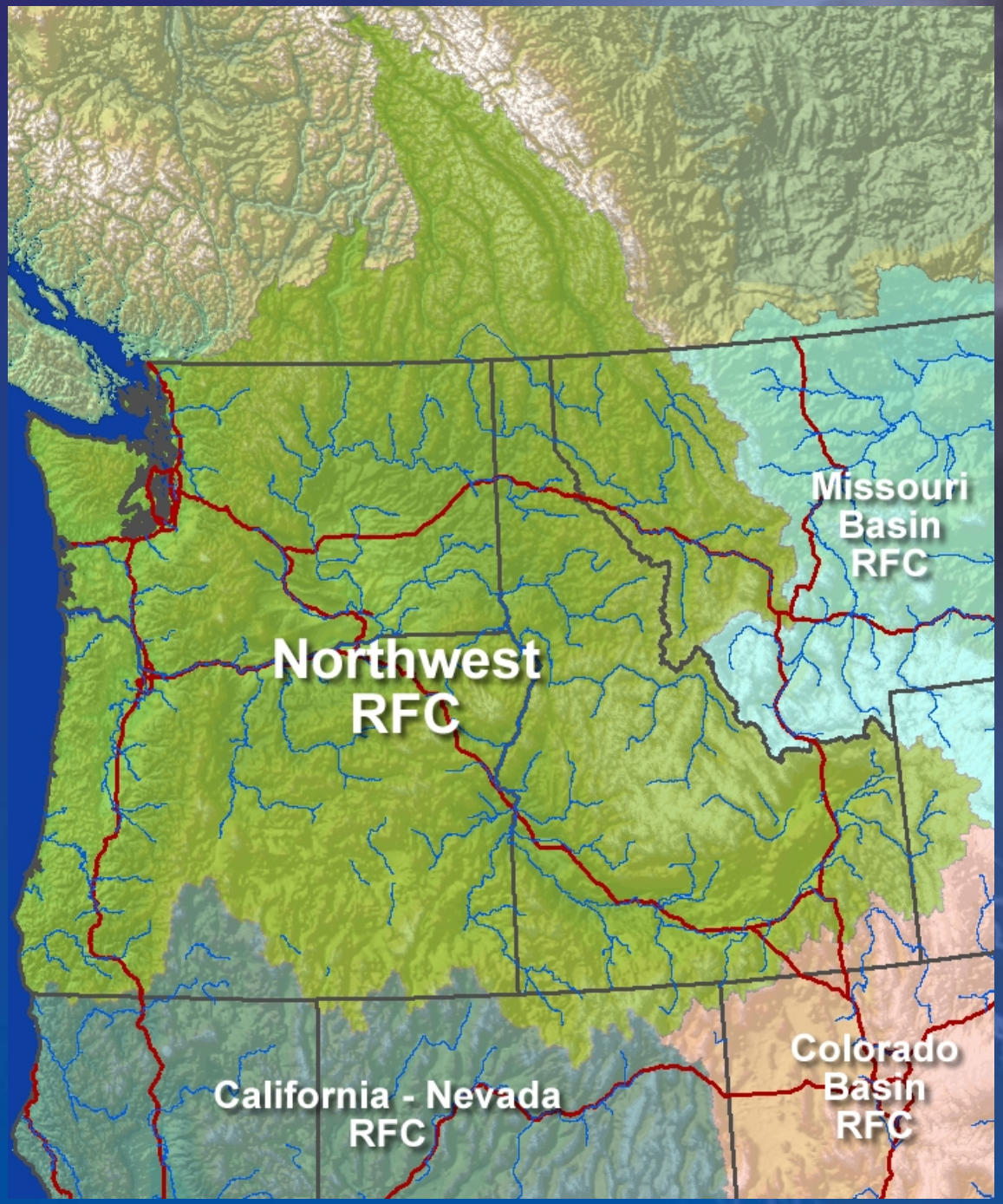
Weather Forecast Offices Serving the Pacific Northwest

WFO Portland

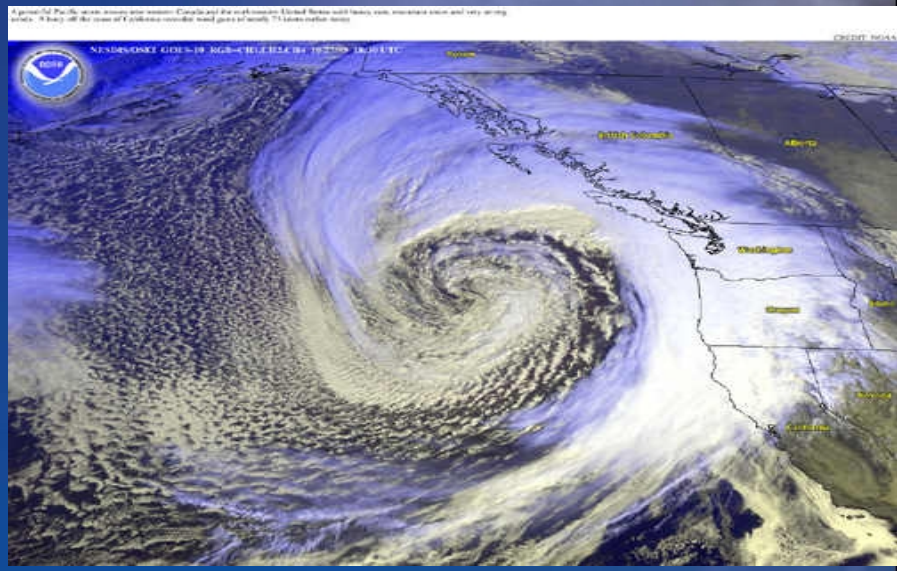
- Domain
  - *Cowlitz County, WA to Lane County, OR*
  - *Cascade Crest to 60nm offshore*
- Population – 3.5 million
- Area – 21,898 square miles
- 14 counties in NW Oregon
- 5 counties in Washington west of the Cascade Crest
- Coastal waters offshore to 60 nautical miles

River Forecast Centers Serving the Pacific Northwest



Overview

- NWS Bulletins
- Windstorms
- Snow and Ice Storms
- Other Winter Hazards
  - Dense fog
  - Blizzard
  - Extreme cold
- River Flooding
- Getting Information



NWS Bulletins

OUTLOOK –

WATCH –

WARNING –

ADVISORY –

NWS Bulletins

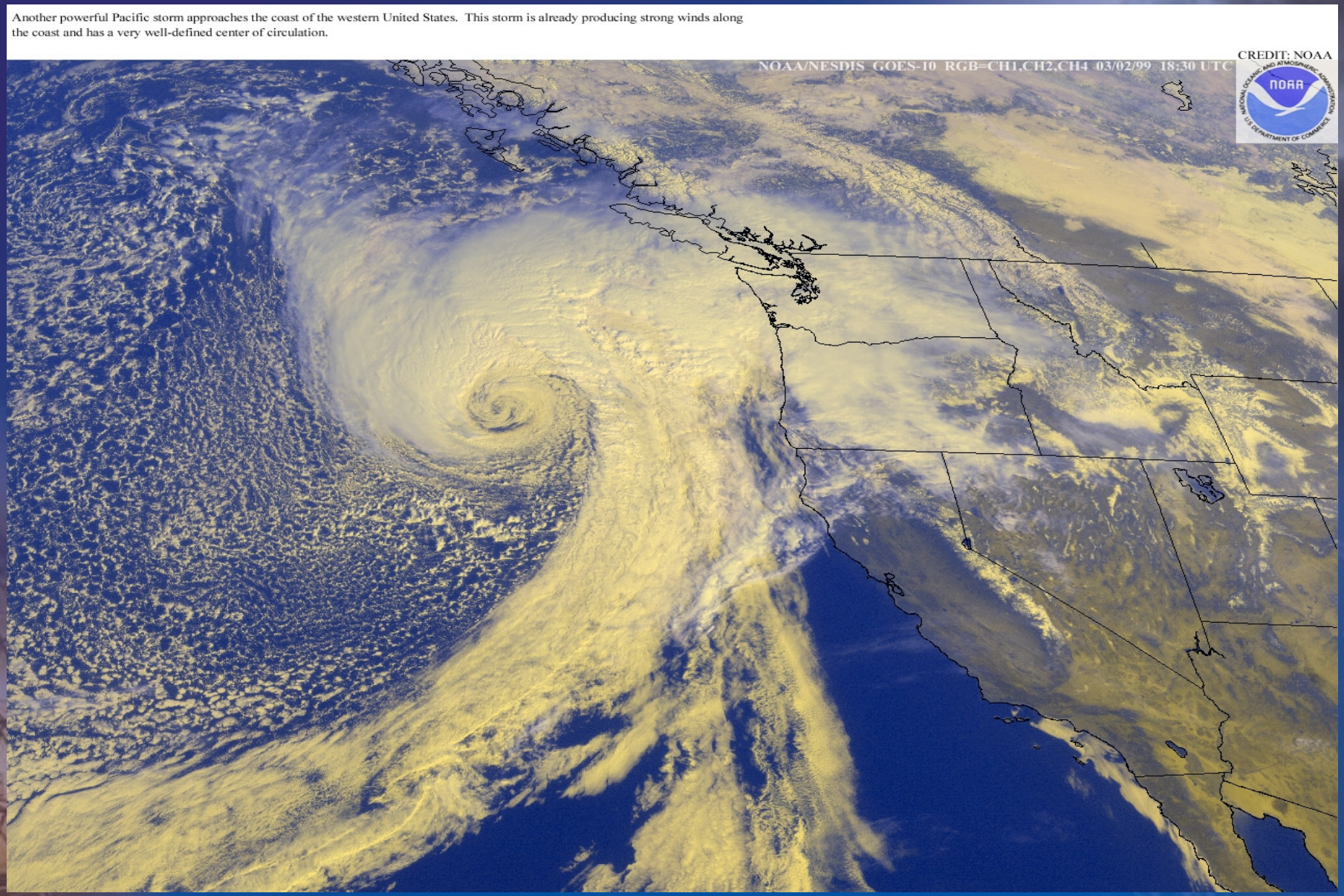
- **Outlook:** *Issued when there is a potential for hazardous weather within the next few days*
  - Intended for people who need long lead times to prepare (2 to 5 days)
- **Watch:** *Issued when there is a threat of hazardous weather, but the timing, location, and occurrence still uncertain.*
  - Goal is to raise awareness
  - 12-72 hrs lead time

NWS Bulletins

- **Warning:** *Issued for weather events that are deemed life threatening or can cause significant damage to property*
  - *0 to 24 hrs lead time*
- **Advisory:** *Issued for events that may cause significant inconvenience, and if caution is not exercised, could lead to situations that may threaten life and/or property*
  - *0 to 24 hrs lead time*

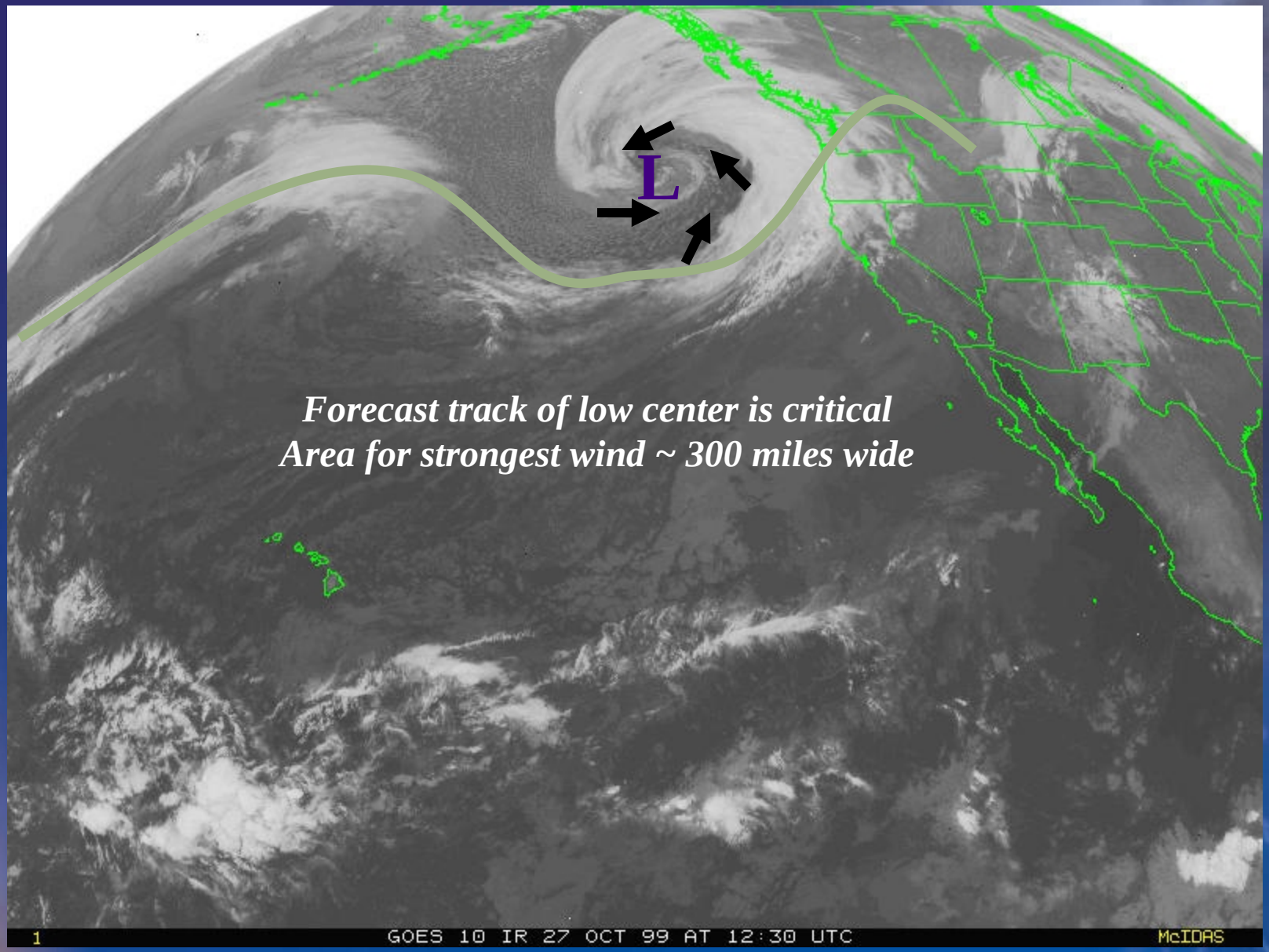
Windstorms

Another powerful Pacific storm approaches the coast of the western United States. This storm is already producing strong winds along the coast and has a very well-defined center of circulation.



Windstorm Basics

- October – March
- Strong low pressure systems develop offshore
- Need strong upper low or jet stream
- Big storms develop every winter
  - Movement & position determines impact
  - High winds at coast are frequent
    - East of the Coast Range – once/twice a season
    - Major storm ~ every 10 yrs
- Forecast of the Storm's Track is Critical, and small errors in track can affect inland forecast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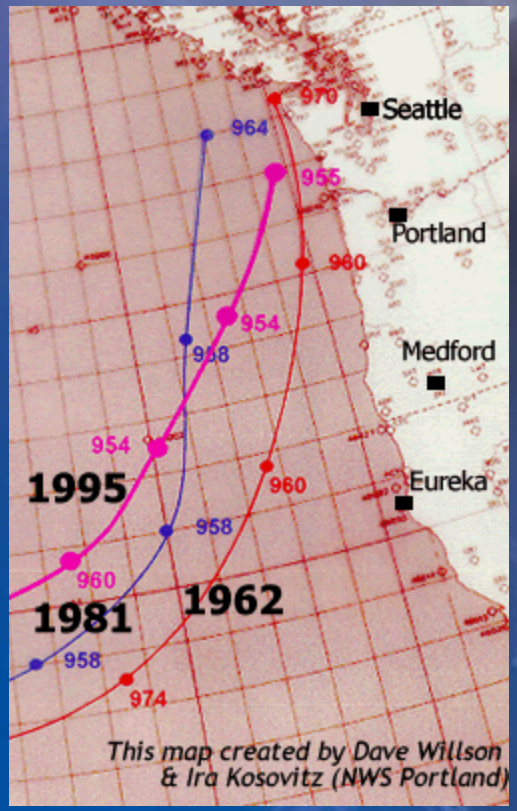
Forecast track of low center is critical
Area for strongest wind ~ 300 miles wide
1
GOES 10 IR 27 OCT 99 AT 12:30 UTC
McIDAS

Windstorm Characteristics

- High Winds
  - Coast - frequent
  - East of the Coast Range – once/twice a season
    - Major storm every ~ 10 yrs
- Most damage due to trees falling
  - Close roads
  - Utilities/power outages
  - Structures damaged
  - Vehicles crushed
  - Time of year, soil moisture, previc storms
- Threshold for damaging wind speeds vary
  - Valley 40 mph G60 mph
  - Coast 40-50 mph G60-70 mph
  - Gorge/Cascades 50 mph G75 mph
- Valley locations will have damaging winds for ~6 hours
  - Coast ~12 hours

Historical Wind Storms:
Columbus Day Storm: Oct 12, 1962

TWO GIANT trees were hurled onto the front of this house at 2335 NW Flanders St. by the Friday night windstorm. Damage to sidewalks and curbing was more extensive than to the house. (Von Wald Photos)



Historical Wind Storms:
Columbus Day Windstorm

- October 12, 1962
  - 150 mph sustained, 179 mph gusts Cape Blanco
  - 170 mph gusts Mt Hebo
  - 138 mph Newport
  - 127 mph Corvallis
  - 116 mph Portland
  - 106 mph Troutdale
- 46 deaths region wide
  - Falling trees, boats sinking, millions lost in timber
  - ~$235M damage ($1.4B today's dollars)
- Definitive weather disaster of the Pacific NW

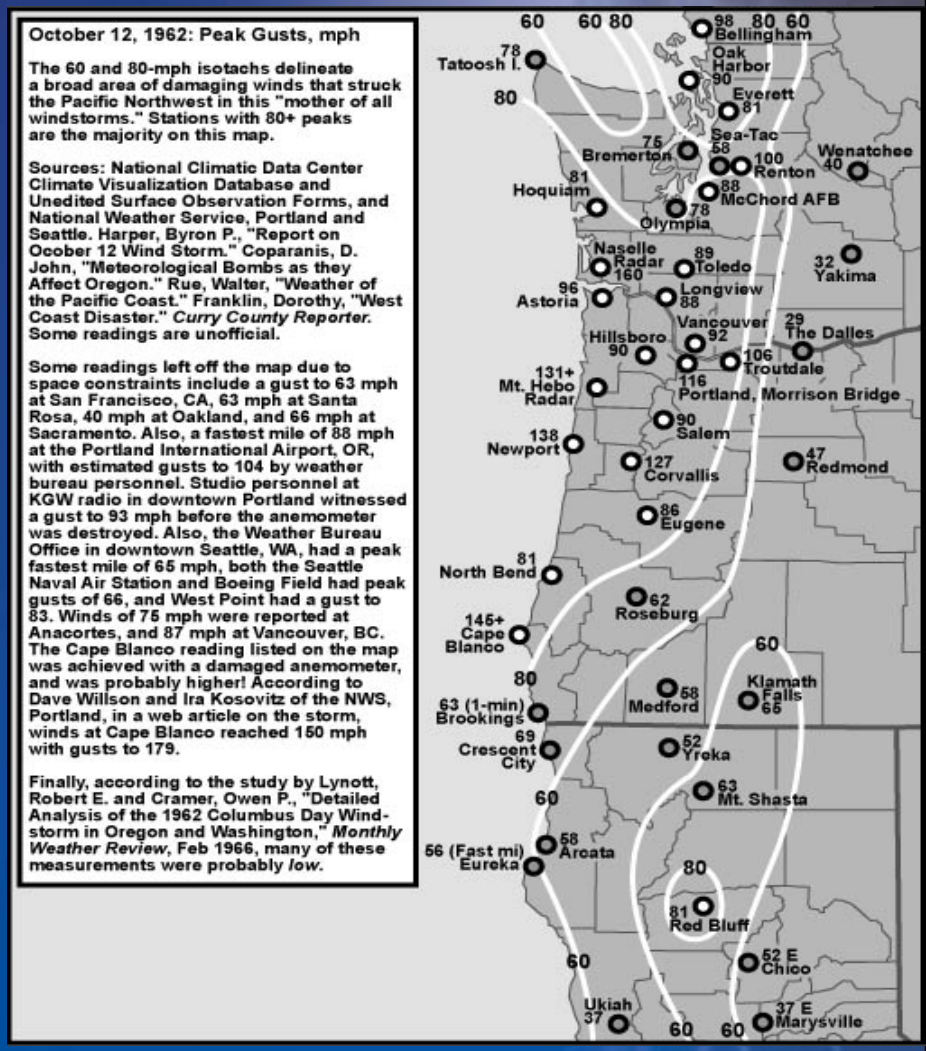


Image courtesy of Wolf Read

Historical Wind Storms:
Dec 12, 1995 Windstorm

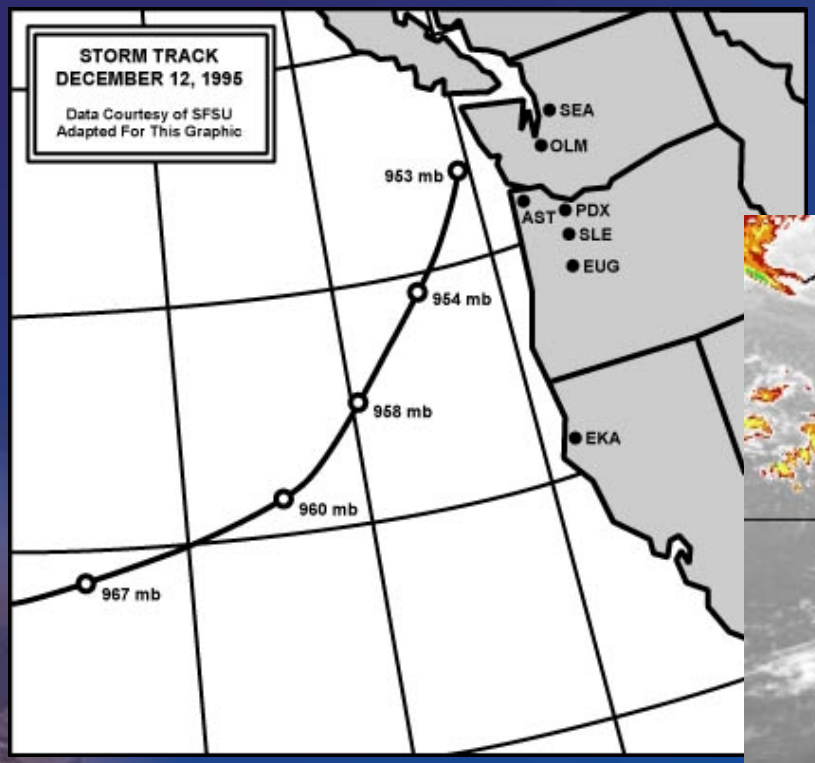
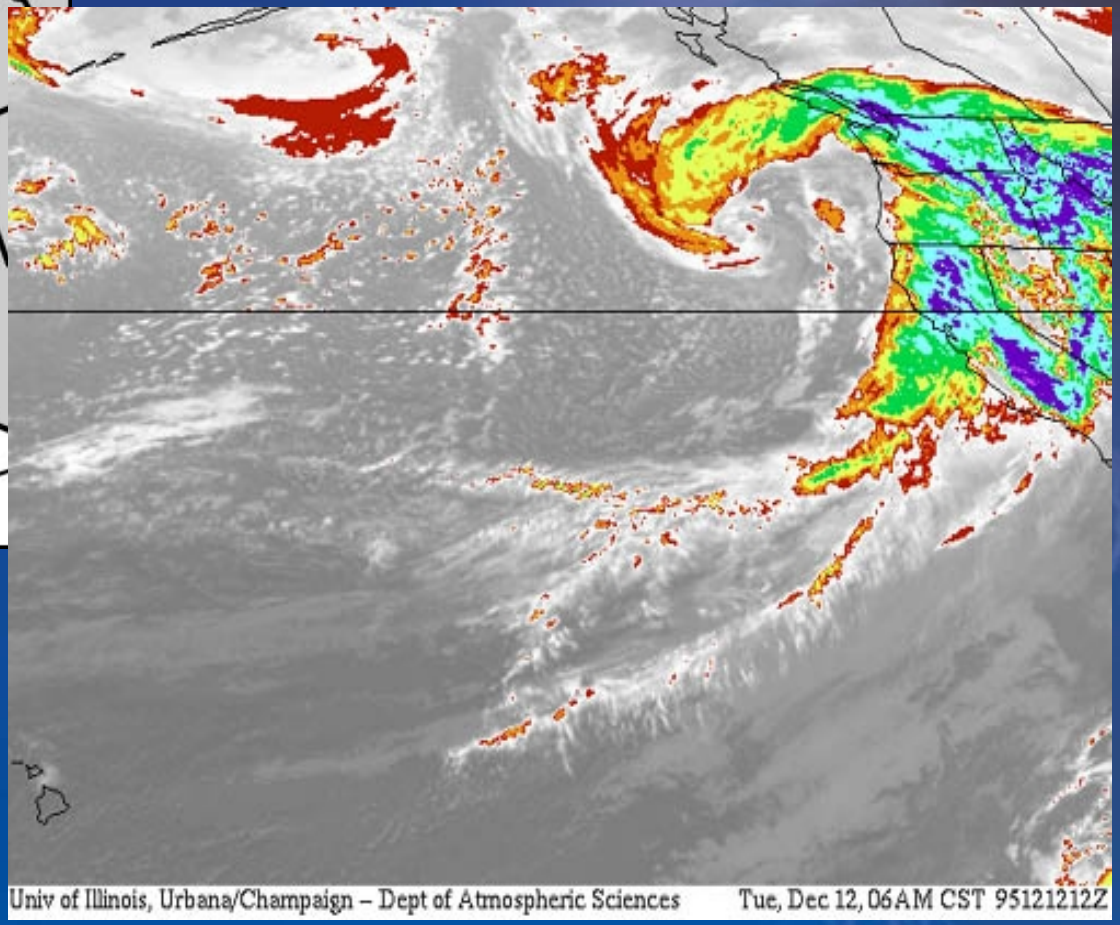


Image courtesy of Wolf Read



Historical Wind Storms: Dec 12, 1995 Windstorm

- Peak Gusts
  - 119 mph Sea Lion Caves
  - 112 mph Cannon Beach
  - 110 mph Cape Blanco
  - 107 mph Newport
  - 95 mph Tillamook
  - 74 mph Portland
  - 59 mph Salem
  - 60 mph John Day
- Two fatalities
- Presidential Disaster Declaration
  - ~$8.2M (public infrastructure)
  - Significant property damage
    - Falling trees, utilities, power infrastructure

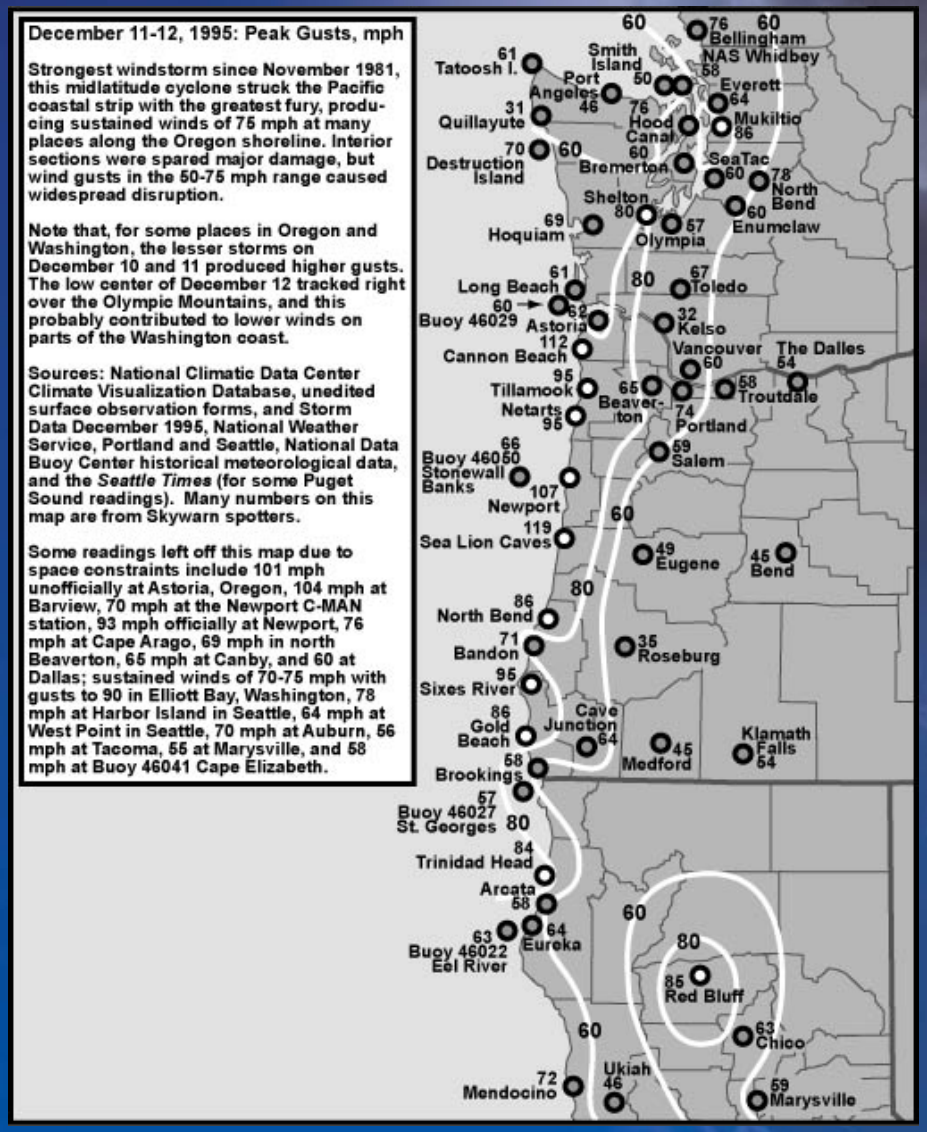
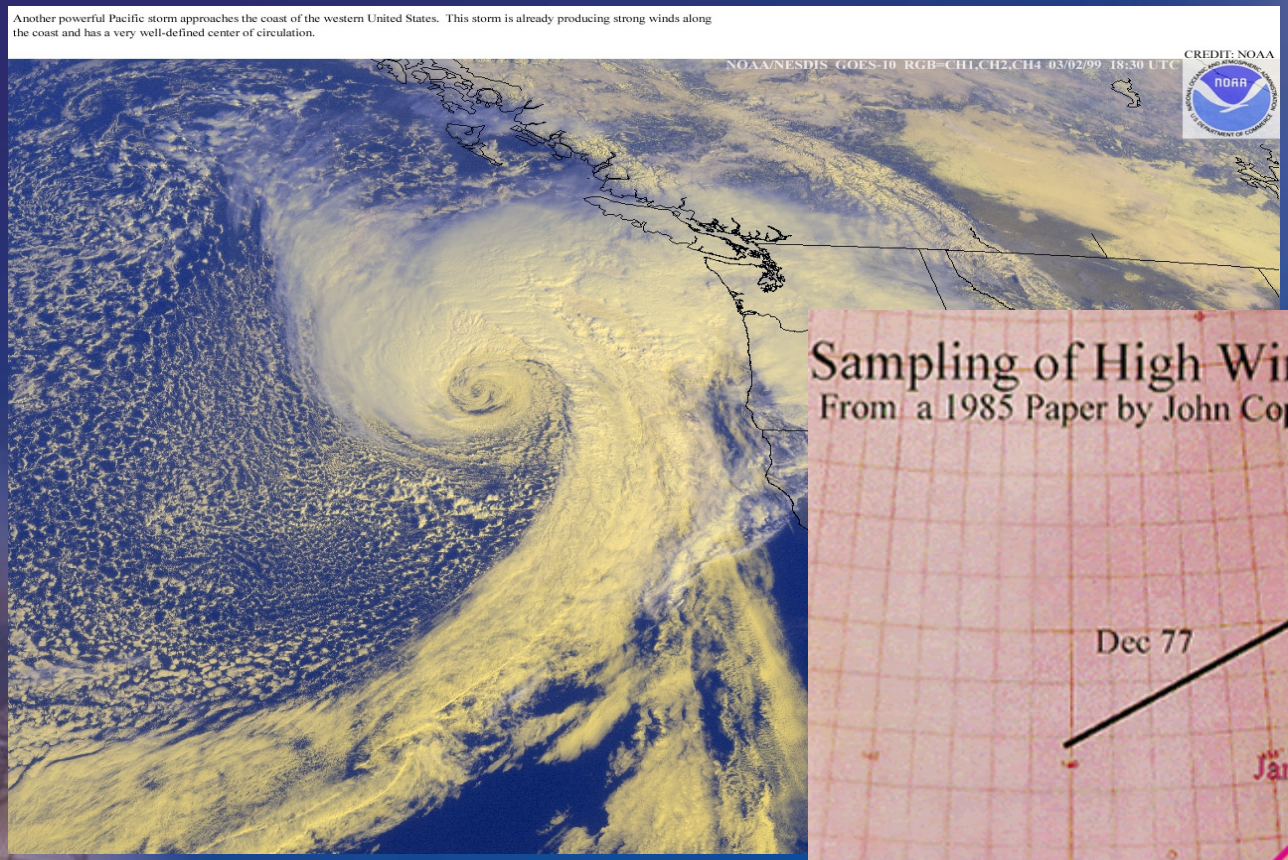
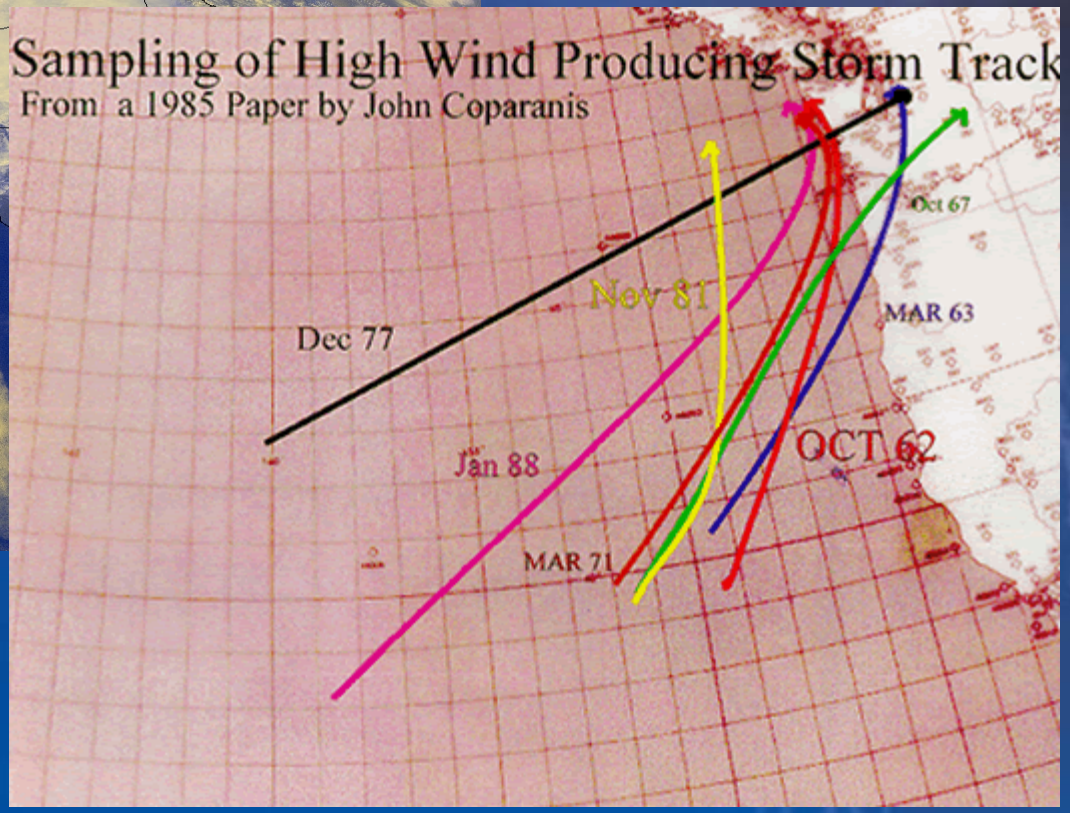


Image courtesy of Wolf Read

Historical Wind Storms:
Dec 2-3, 2007 Windstorm





Historical Wind Storms:
Dec 2-3, 2007 Windstorm

- Peak Gusts
  - 129 mph Bay City
  - 125 mph Lincoln City
  - 114 mph Cape Meares
  - 104 mph Rockaway Beach
  - 102 mph Kilpsan Beach (SW WA)
  - 102 mph Tillamook Bay
  - 91 mph Mt Hebo
  - 88 mph Yaquina Bay Bridge
  - 83 mph Newport
  - 81 mph Sea Lion Caves
  - 80 mph Cannon Beach
  - 77 mph Cape Foulweather


Astoria residential area, Daily Astorian

- 44-48 foot seas (buoy reports 20 nm offshore)
- Thousands of people without power in WA /OR for 5 days
- Presidential Disaster Declaration
  - Significant property damage
    - Falling trees, utilities, power


Astoria, building damage, Daily Astorian

Damage Photos

Clatsop State Forest near Seaside

Damage Photos

100+ mph wind damage

Astoria

Pacific City – Sand Dunes

(100+ mph winds)

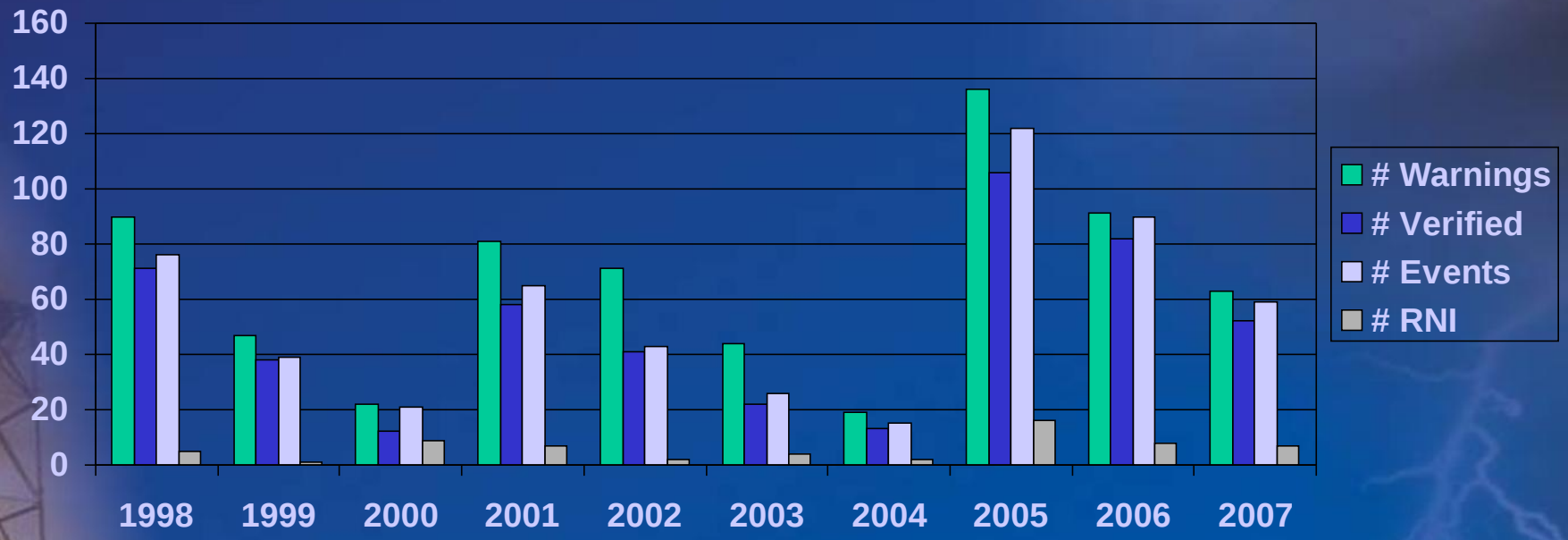
Windstorm Damage
February 2002, Eugene

Key Thresholds for Wind Warnings

- *Coast, Coast Range, Inland Lowlands:*
  - 40 mph (sustained)
  - 58 mph (gusts)
- *Cascades and Columbia Gorge:*
  - 50 mph (sustained)
  - 75 mph (gusts)
- In *coastal waters*, “Hurricane Force Warning” = winds 64 KT (74 mph) or greater

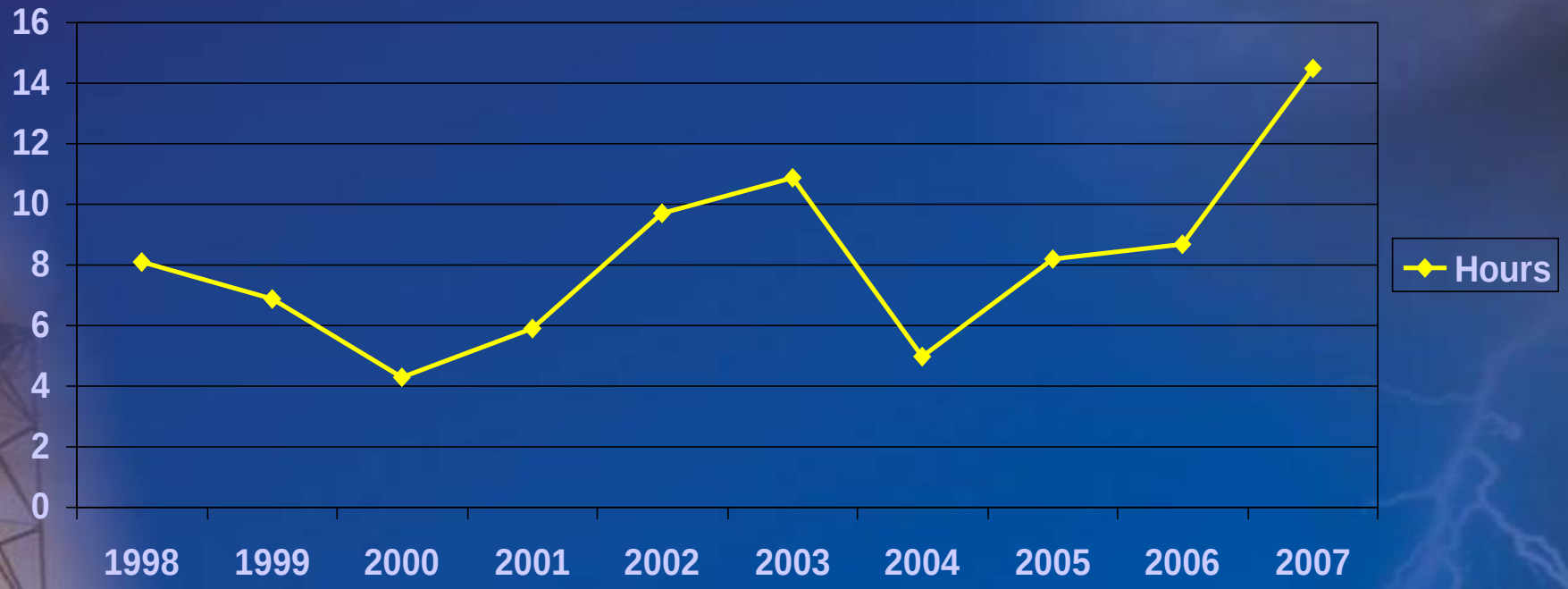
Performance Measures

Wind Warning and High Wind Event totals

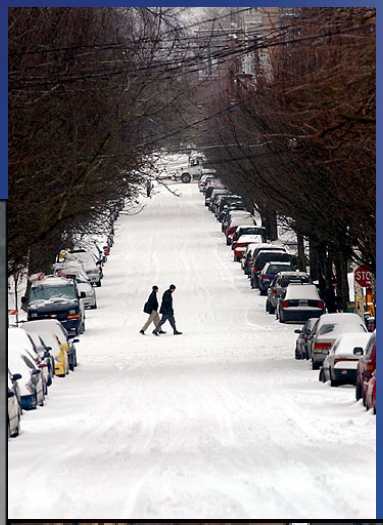


Performance Measures

Average Lead Time For Warnings



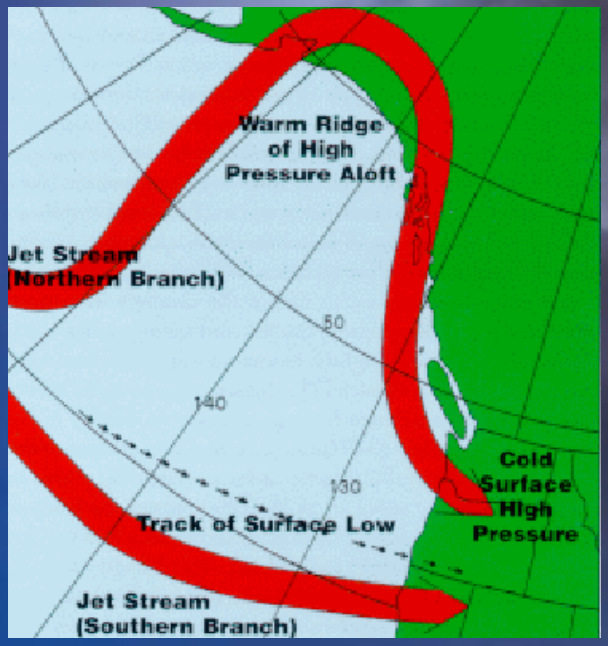
Snow and Ice Storms

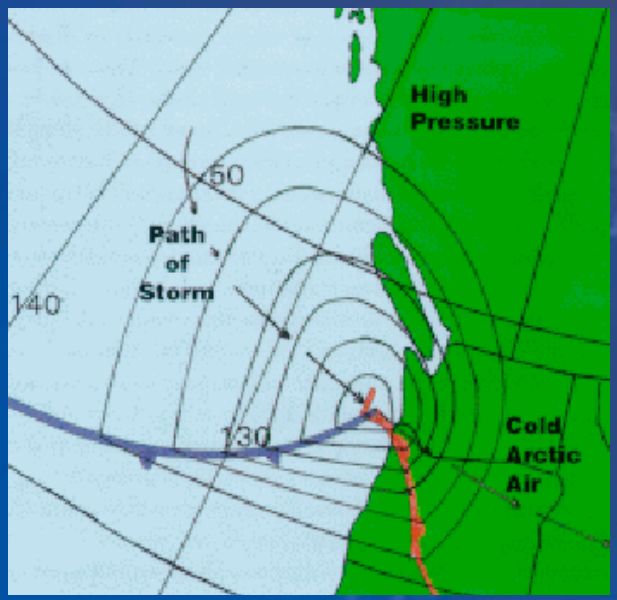


Snow Storm Characteristics

For significant snow events to occur in the Portland area (and Willamette Valley), we need:

- Moisture
  - ✓Pacific Ocean
- Cold continental air
  - ✓Alaska
  - ✓Yukon /British Columbia
  - ✓Columbia Basin
  - ✓It’s rare, but can happen!





Historical Snowfalls: January 1950

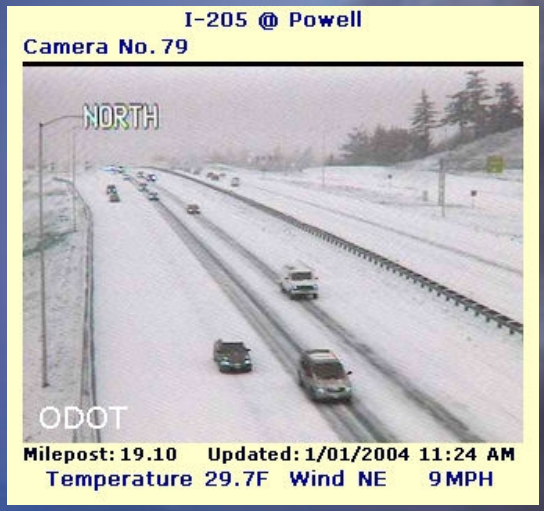
- 41.4 inches of snow at PDX
  - Previous record 35.3 inches, 1890
- 36.1 inches at Eugene
  - Previous record 26.0 inches, 1916
- 32.8 inches at Salem
  - Previous record 22.1 inches, 1943
- 31.1 inches at SEA
- 13 lives lost in Puget Sound area
- 21 days of measurable snowfall at PDX in Jan 1950

Salem, 1950

Portland, 1969

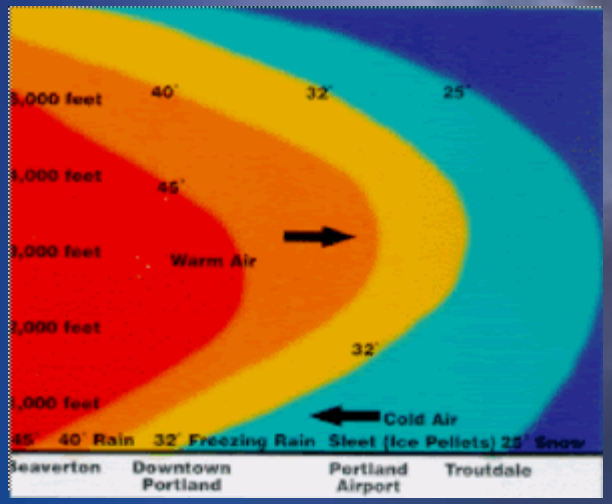
January 2004

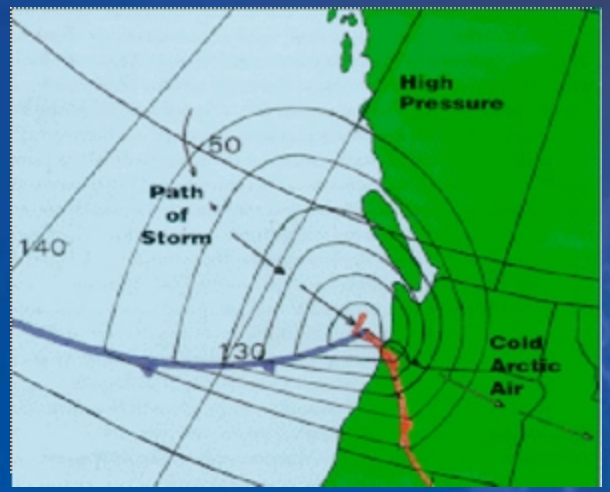
- 6 to 10 inches of snow in downtown Portland and Willamette Valley
- Followed by 2 days of freezing rain
- Significant impact on City and State resources



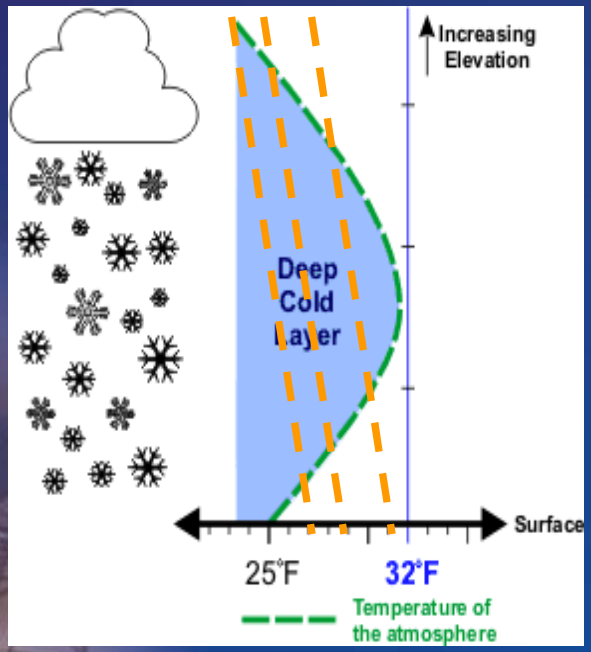
Ice Storms

- Cold continental air moves through terrain gaps
  - Columbia Gorge
- Shallow layer of cold air near the ground
- Warm air moving in aloft with approaching storm
- Can cause extensive

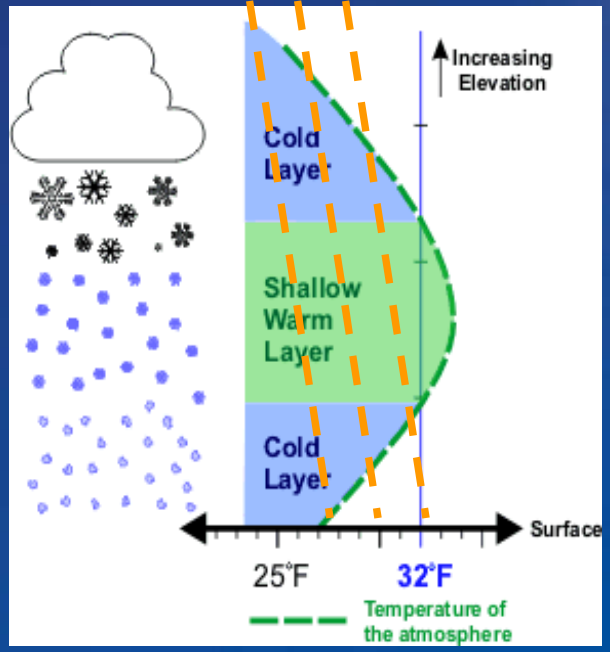




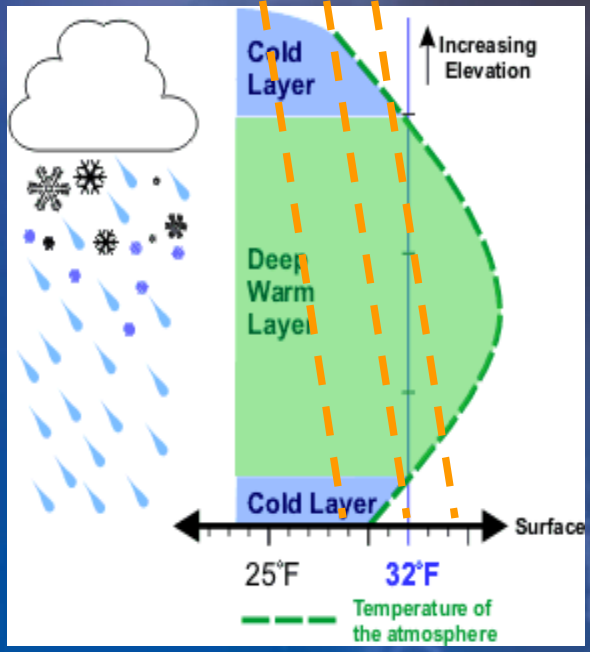
Frozen Precipitation



Snow

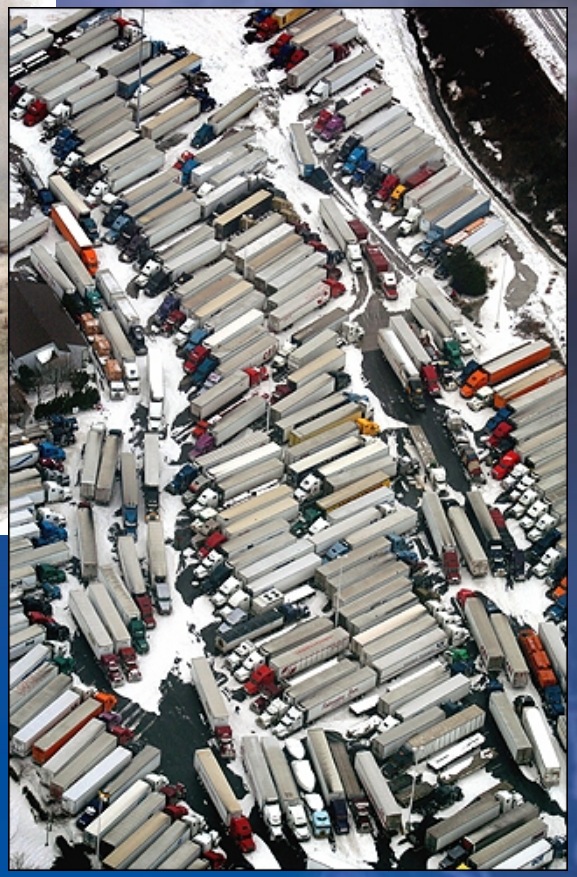


Sleet



Freezing Rain

Notable Ice Storms:
Dec 1996 & Jan 2004

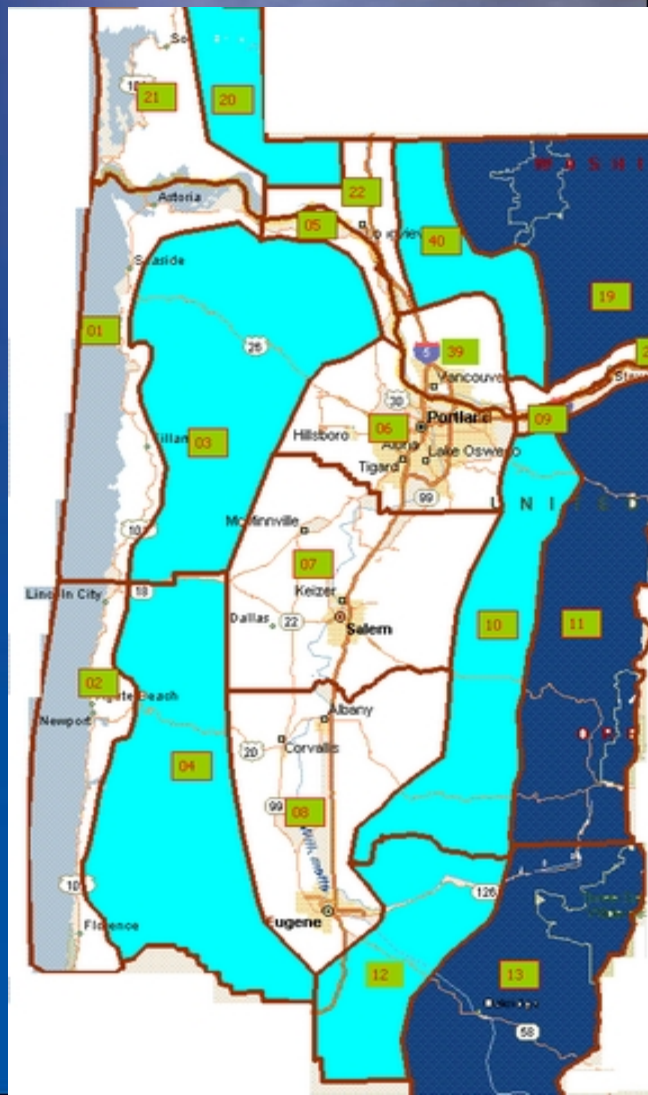


Forecast Challenges with Snow & Ice

- Low elevation snow
  - Conditions must be right for snow at airport
  - Southerly wind – very hard to get snow to valley floor
  - Challenging forecast
- Cold, shallow air mass after an ice storm
  - Tend to try to “scour out” cold air too quickly

Key Winter Storm Thresholds

- *For 12-hour accumulations:*
  - Snow Advisory
    - 1 to 3 inches Valley Floor
    - 3 to 5 inches Coast Rng/Foothills
    - 6 to 11 inches Cascades
  - Heavy Snow Warning
    - 4” or more Valley floor
    - 6” or more Coast Rng/Foothills
    - 12” or more Cascades
- *For 24-hour accumulations:*
  - Heavy Snow Warning
    - 6” or more Valley floor
    - 10” or more Coast Range
    - 18” or more Cascades

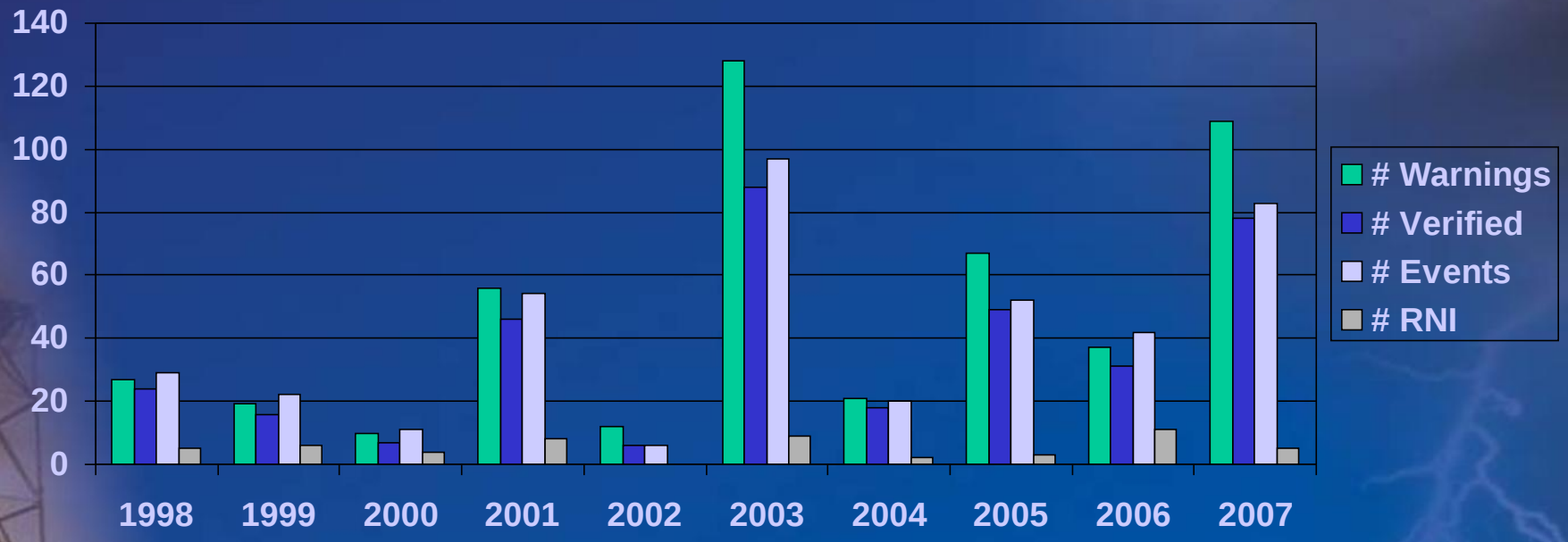


Key Winter Storm Thresholds

- Freezing Rain Advisory
  - Ice accumulations less than ¼ inch over a local area
- Winter Storm Warning
  - Ice accumulations of ¼ or more
  - And/or widespread area

Performance Measures

Winter Weather Warning and event totals



Performance Measures

Average Lead Time For Winter Storm Warnings

Other Winter Hazards

- Dense Fog
- Blizzards, and blowing snow
- Extreme Cold


Floods

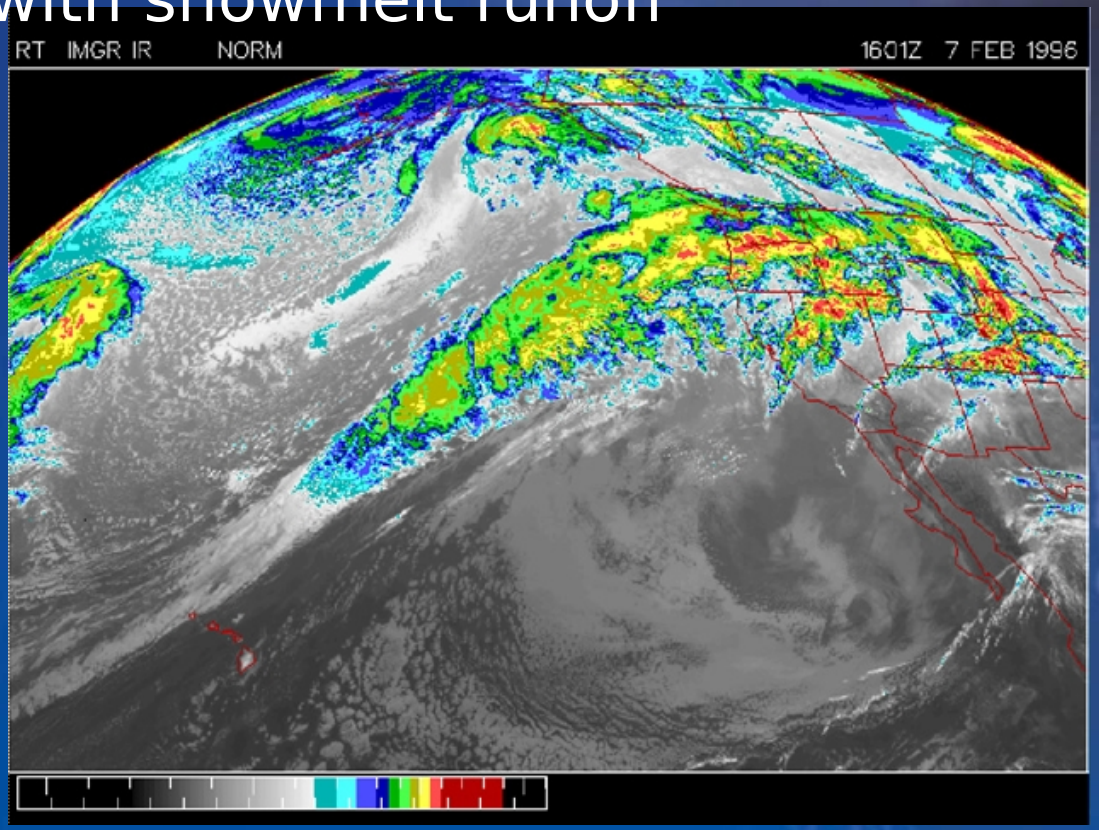
Ingredients for Flooding

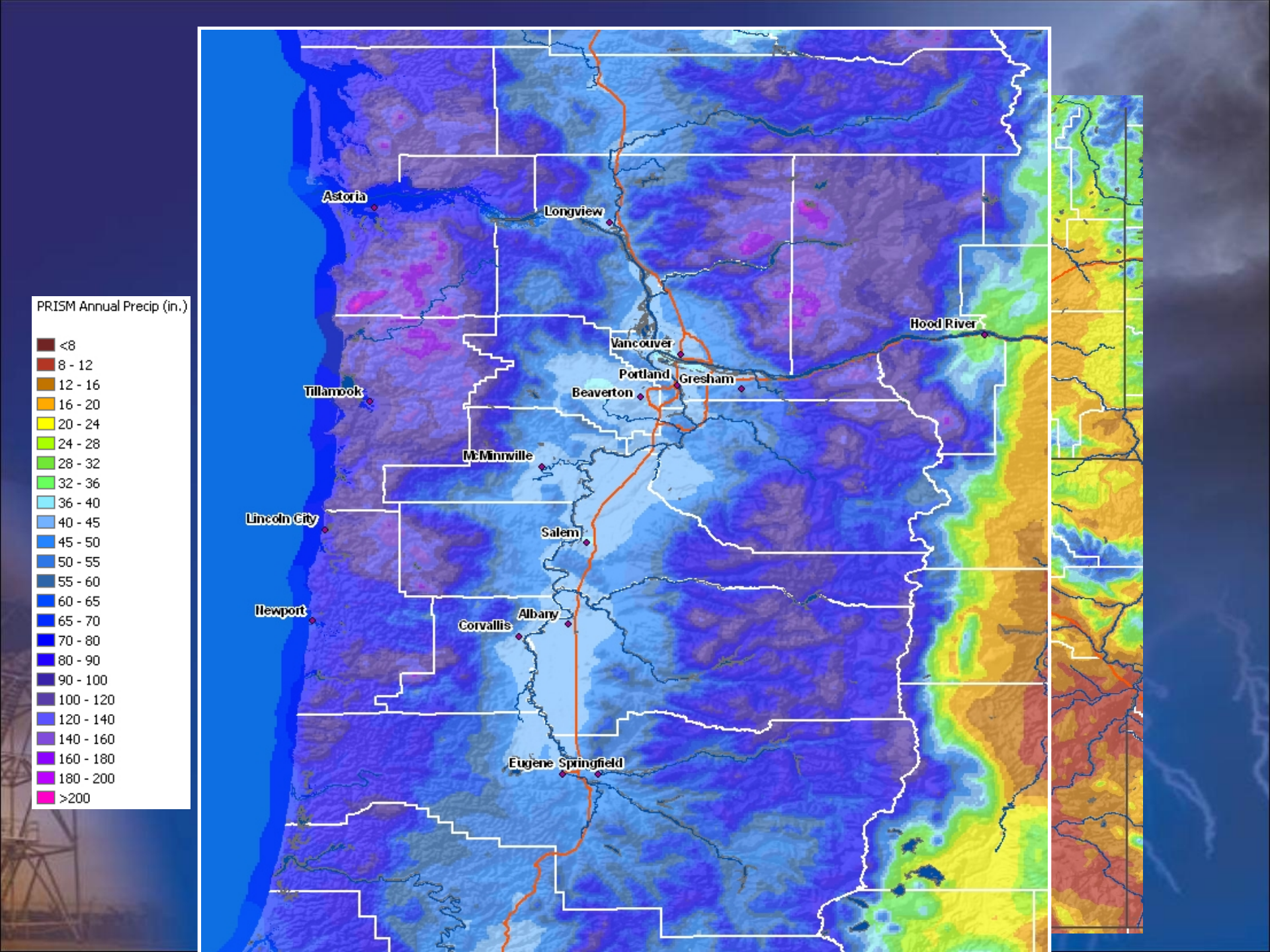
- Nov – Mar: Region subject to flooding *(May – June, possibility of Spring flooding on Columbia)*

- Major flooding due to:
  - Heavy rainfall over short period of time (2-5 days)
  - Rainfall combined with snowmelt runoff

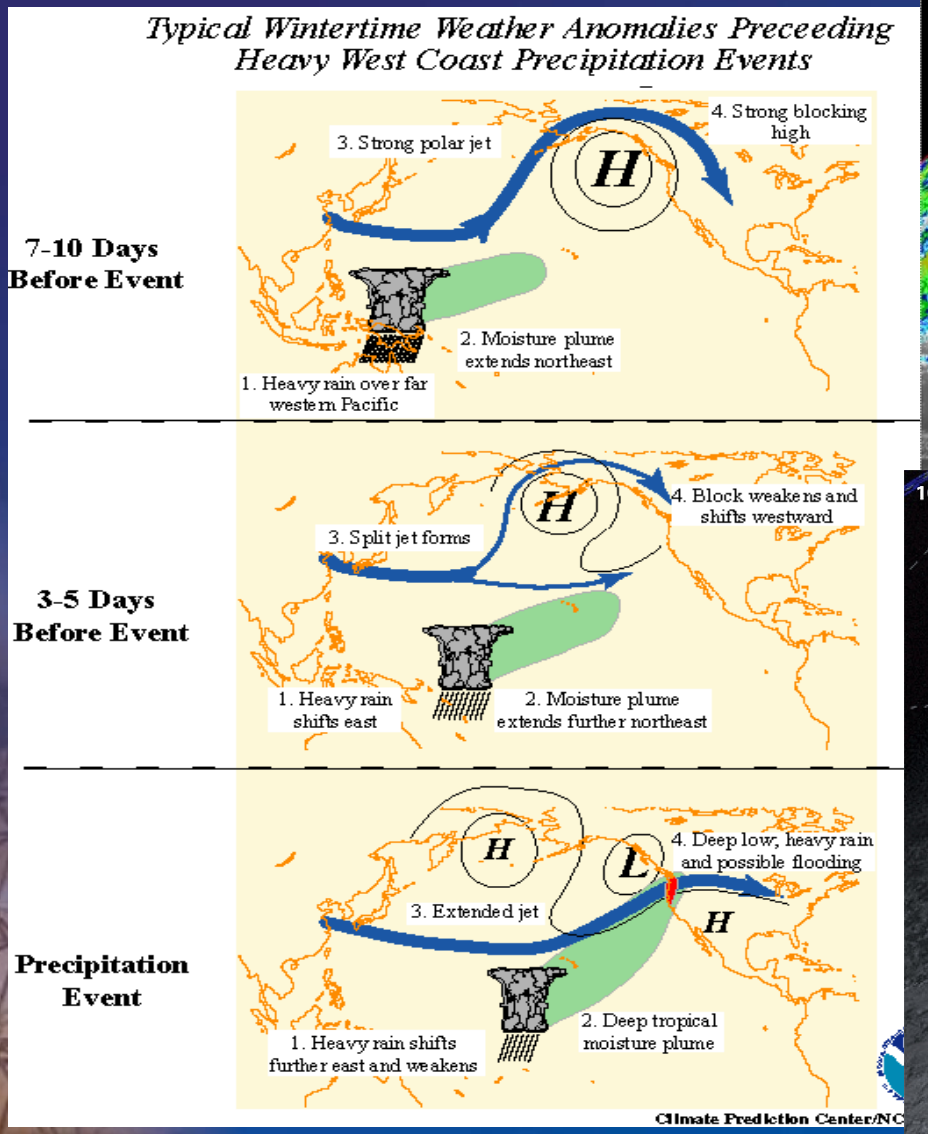
- Rapid transition to a warm and wet pattern: *"Pineapple Express"*

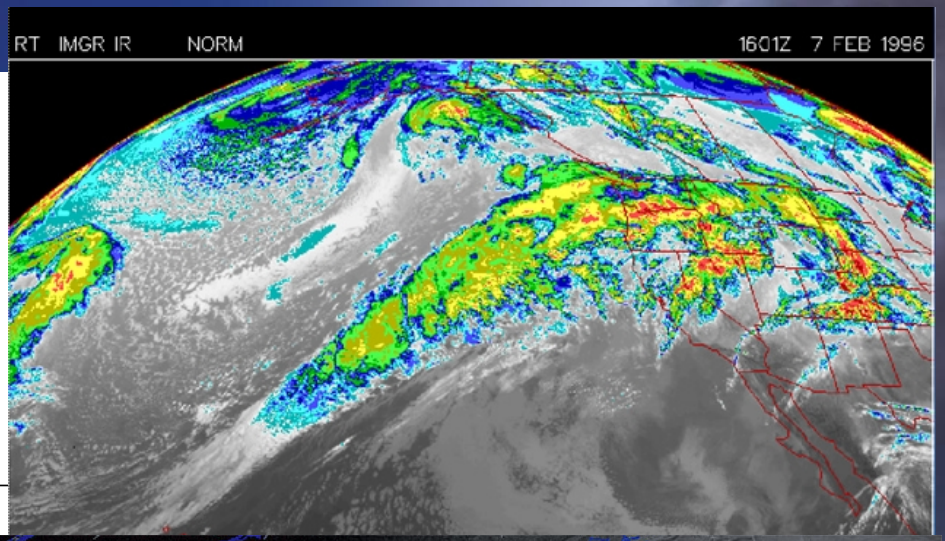
- Combined rainfall & snowmelt runoff can produce significant flooding.

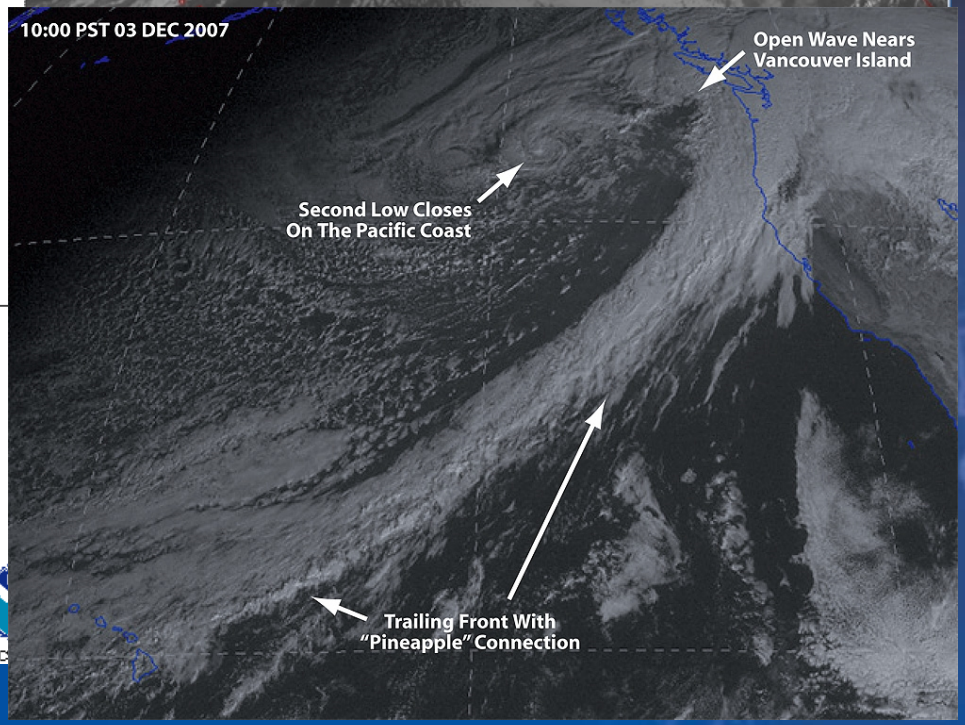



PRISM Annual Precip (in.)
<8
8 - 12
12 - 16
16 - 20
20 - 24
24 - 28
28 - 32
32 - 36
36 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 80
80 - 90
90 - 100
100 - 120
120 - 140
140 - 160
160 - 180
180 - 200
>200
Astoria
Longview
Hood River
Vancouver
Portland
Gresham
Beaverton
Tillamook
McMinnville
Lincoln City
Salem
Newport
Albany
Corvallis
Eugene
Springfield

Pineapple Express







Notable Floods

- December 1964
- February 1996
- November 2006
- December 2007

December 1964 Flood

- Near-record breaking snow in the Cascades & Coast Range
- Followed by a parade of warm subtropical storms
- Snowpack at Government Camp decreased from 55 inches to 5 inches
- River flood levels comparable to 1996 but covered a larger area of the Southern Willamette basin
- Fewer flood-control reservoirs
- 17 deaths, $34 million in damage

February 1996 Flood

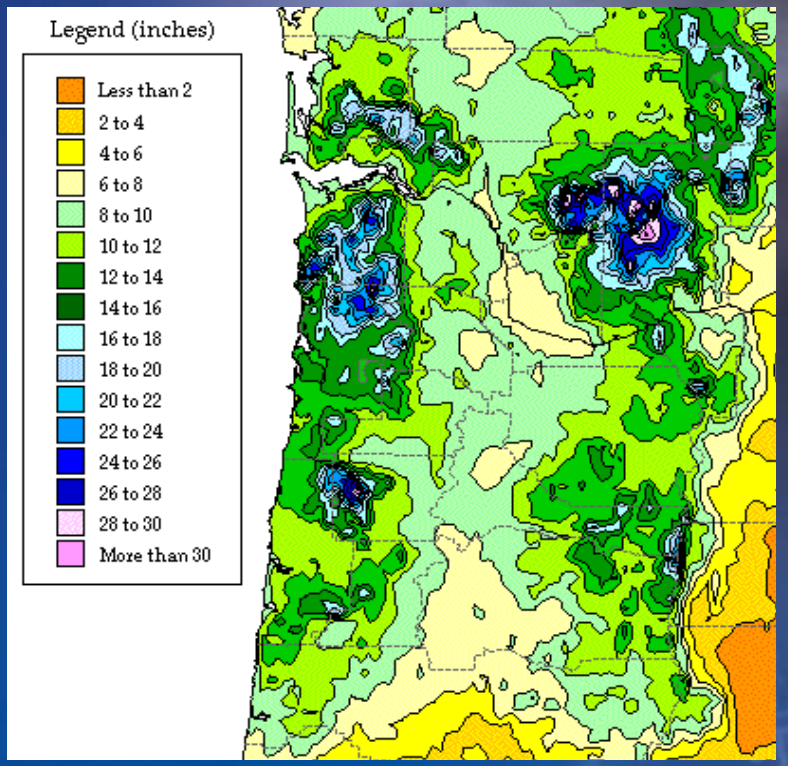
- Unusually wet start to winter of 95-96
- Precip 125% of normal (Oct 95-Jan 96)
- January 15-31, average snowpack increased from 29% to 112% average
- Intense cold spell last week of January
  - Frozen soil
  - River ice, frozen lakes east of Cascades
- Feb 5-9, Pineapple Express: warm temps, heavy rain, melting snow

February 1996 Flood

Feb 6-9 Rainfall
Record Amounts in NW Oregon and SW Washington

Location	Rainfall (inches)
Laurel Mountain	27.88
Gov't Camp	11.30
Eugene	9.14
Salem	8.18
Corvallis	8.10
Portland	7.00

Total Precipitation, NW Oregon and SW Washington, Feb 5-9, 1996



High Elevation Locations
Snow level rose rapidly to 7000-8000 ft, resulting in Snow-Water Equivalent melt

Location	Precip (in.)	SWE Loss (in.)	Total Runoff (in.)
Marion Forks	11.1	12.2	23.3
Blazed Alder	18.3	1.8	20.1
Peavine Ridge	10.6	5.5	16.1

November 6-8, 2006 Flood

Tropical moisture connection, extreme precipitation rates, rainfall runoff only, no pre-existing snowpack

Location	Max 24 hr Precip (in.)	Date of Max Precip	Nov 6-8 Precip (in.)
June Lake, WA*	15.2	Nov 7	24.4
Swift Creek, WA	14.6	Nov 7	22.5
Lee's Camp, OR*	14.3	Nov 6	26.4
Mt. Hebo, OR	9.6	Nov 7	22.8
North Fork, OR	11.5	Nov 6	29.1
Blazed Alder, OR	10.0	Nov 7	24.2

(*) Oregon State rainfall record for 24 hr period

November 6-8, 2006 Flood

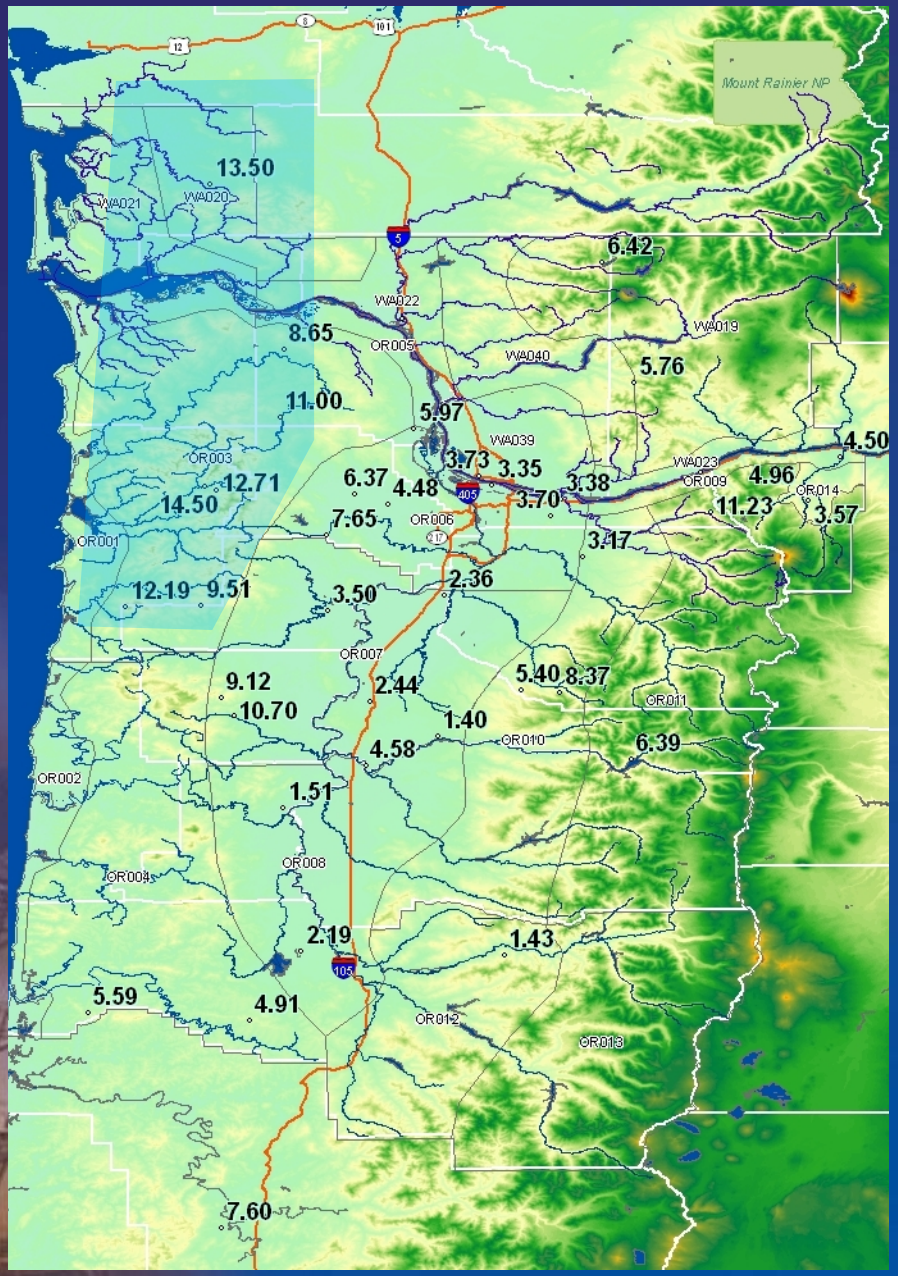
Wilson River, Tillamook

White River, Hwy 35, Hood River County

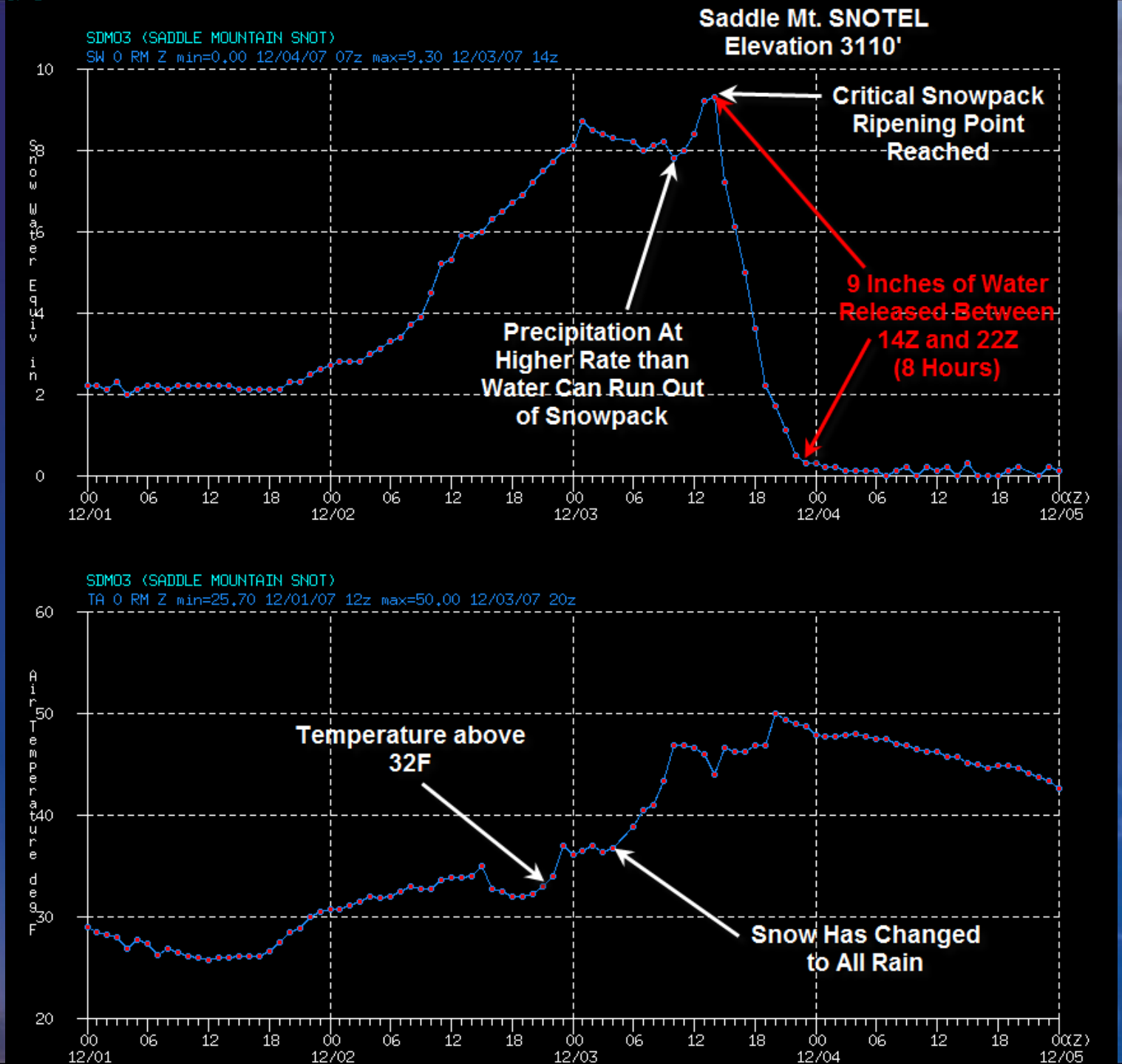
Cowlitz River near Packwood

Hood River, Railroad Bridge

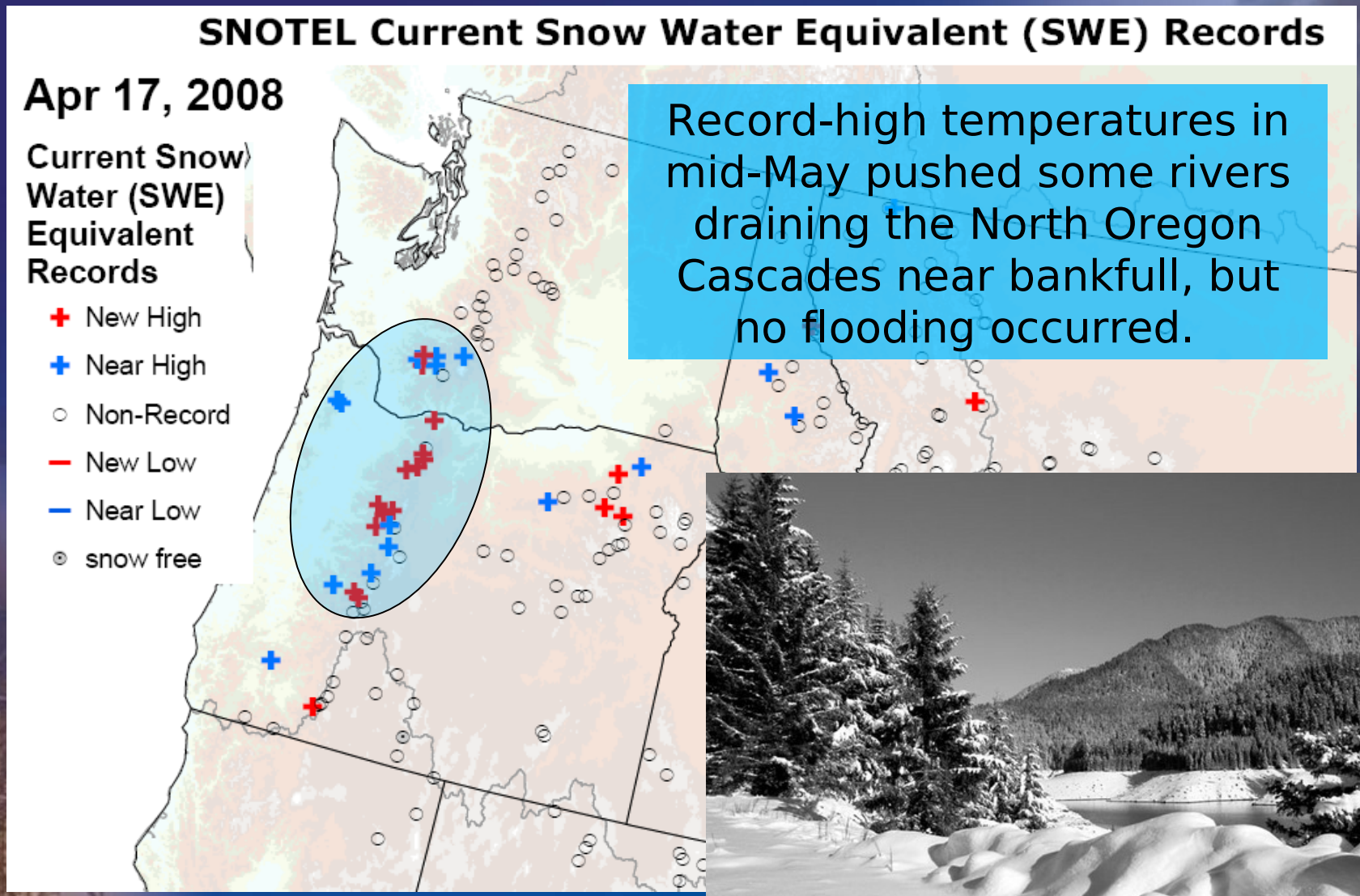
December 2-5, 2007 Flood



- Intense, heavy precipitation, with highest amounts 11 – 15”,
- Peak rainfall rates over ½ inch per hour for several hours on Dec 2nd and 3rd
- Significant snowfall above 2000 ft just prior to onset of heavy rain.
- Major flooding on the Wilson, Nehalem, Grays, Willapa, and Marys Rivers, along with many smaller creeks, mainly draining the NW Oregon & SW Washington Coast Range
- Widespread flooding on other coastal rivers and Willamette Valley tributaries

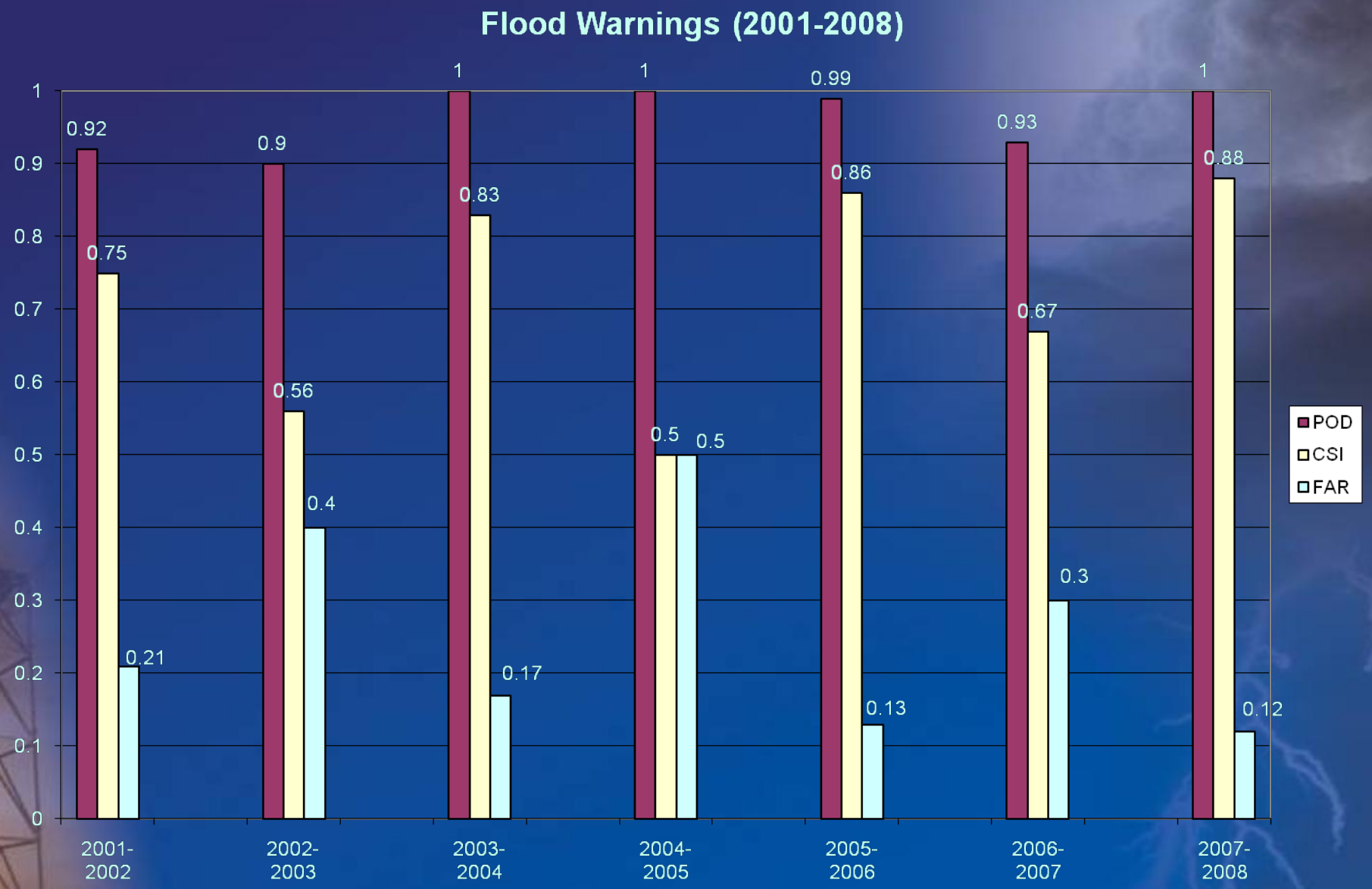

Saddle Mt. SNOTEL
Elevation 3110'
SDMO3 (SADDLE MOUNTAIN SNOT)
SW 0 RM Z min=0.00 12/04/07 07z max=9.30 12/03/07 14z
Snow Water Equiv in
10
8
6
4
2
0
Critical Snowpack Ripening Point Reached
9 Inches of Water Released Between 14Z and 22Z (8 Hours)
Precipitation At Higher Rate than Water Can Run Out of Snowpack
00 06 12 18 00 06 12 18 00 06 12 18 00 06 12 18 00(Z)
12/01 12/02 12/03 12/04 12/05
SDMO3 (SADDLE MOUNTAIN SNOT)
TA 0 RM Z min=25.70 12/01/07 12z max=50.00 12/03/07 20z
Air Temperature deg F
60
50
40
30
20
Temperature above 32F
Snow Has Changed to All Rain
00 06 12 18 00 06 12 18 00 06 12 18 00 06 12 18 00(Z)
12/01 12/02 12/03 12/04 12/05

Spring Snowmelt Flooding

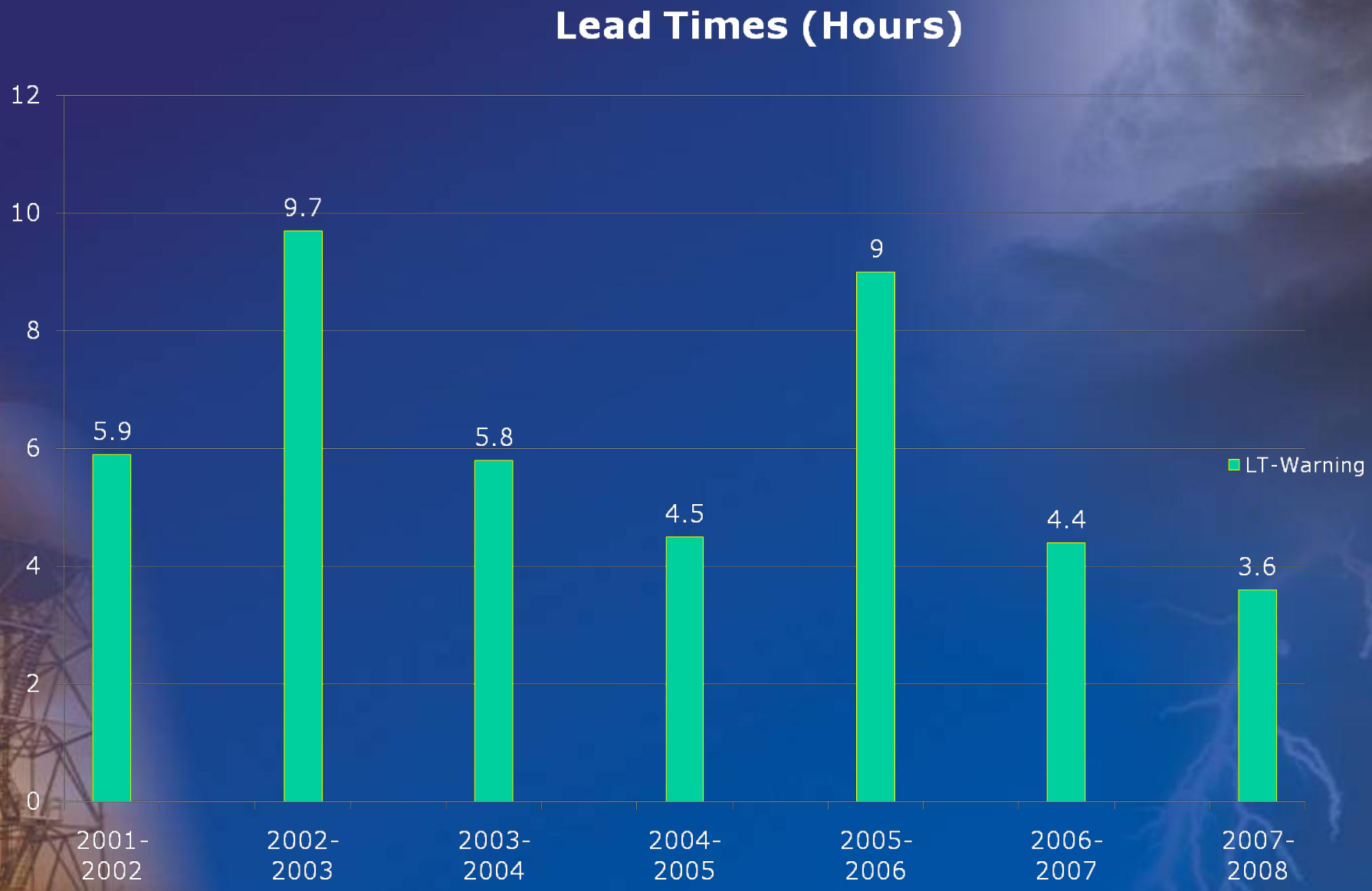


Record-high temperatures in mid-May pushed some rivers draining the North Oregon Cascades near bankfull, but no flooding occurred.

Performance Measures



Performance Measures

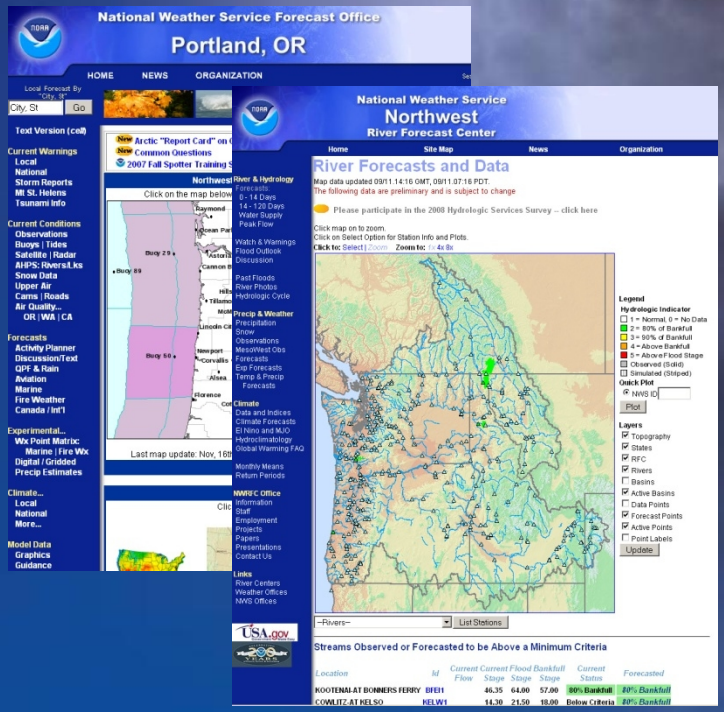


How do we Mitigate the Effects of these type of Storms?

Being Prepared and Informed

How to Get Information

- Internet
  - NWS Portland:
    weather.gov/portland
  - Northwest River Forecast Center:
    www.nwrfc.noaa.gov



- NOAA Weather Radio
- LEDS (OR) & ACCESS (WA)
- EMWIN
- Email
- Phone: 503-261-9246, press #
  - » Unlisted number available